WATER RESOURCES REVIEW for AUGUST 1977

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

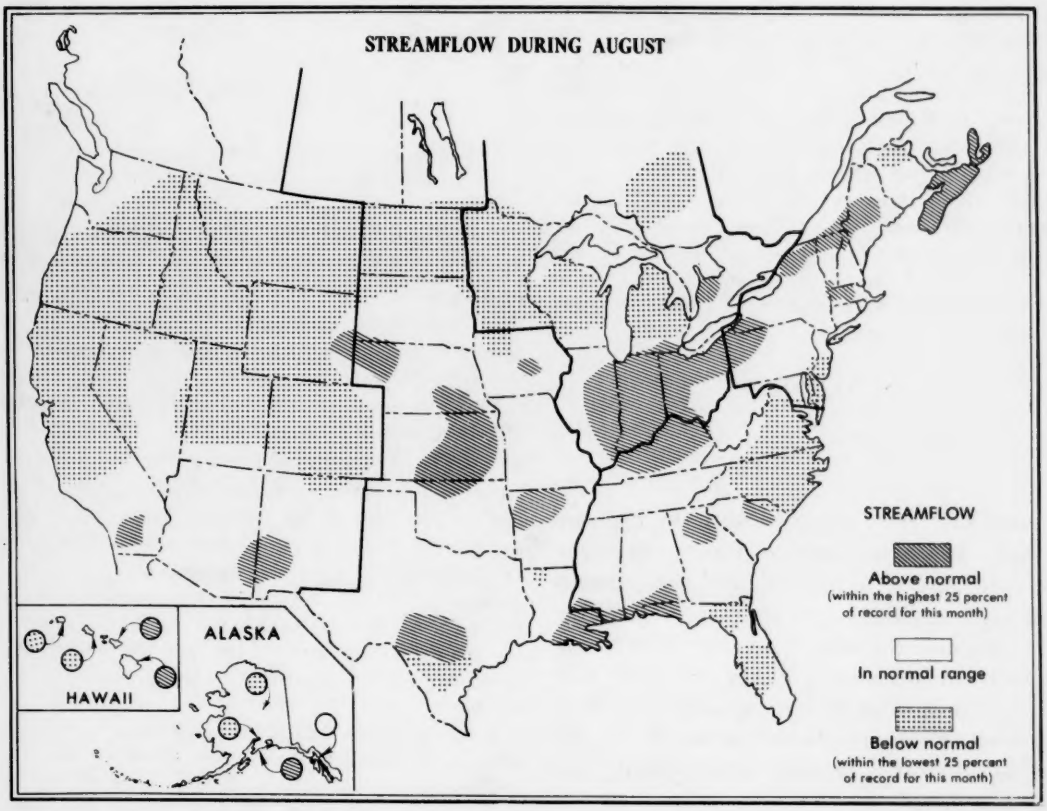
STREAMFLOW AND GROUND-WATER CONDITIONS

Streamflow generally decreased seasonally in southern Canada, many northern and western States and was variable elsewhere in the United States. Severe drought conditions continued to grip large areas of the West, but improvement was noted in the Midcontinent. Below-normal streamflow prevailed in about one-third of the United States.

Above-normal flows persisted in Nova Scotia, and in parts of Pennsylvania, Arizona, and Texas and increased into that range in Indiana and parts of most central and eastern States.

Flows were lowest of record in parts of California, Colorado, Iowa, North Carolina, and Utah, and highest of record in parts of Alaska, Kansas, Louisiana, Nebraska, and Pennsylvania. Flooding occurred in parts of California, Colorado, Indiana, Iowa, Minnesota, Nebraska, and Utah.

Ground-water levels continued to decline in much of the Northeast, Southeast, and Western Great Lakes Regions, but with many local rises. Mixed trends occurred in the Midcontinent Region; levels rose Statewide in Iowa, held steady in Kansas, and declined Statewide in North Dakota and nearly Statewide in Arkansas. Except for rises in southern Idaho, declines in water level generally prevailed in the West. Levels were near or above average in most of the Northeast, and below average, except locally, in much of the Southeast and in the Western Great Lakes Regions. Levels were above and below average in the Midcontinent, and generally below average in the West. New monthly highs occurred in West Virginia, Iowa, and in Texas, where a new alltime high also was reached. New monthly lows occurred in Mississippi, Michigan, North Dakota, Washington, Montana, southern California, and Nevada; new alltime lows occurred in Tennessee, Kansas, Texas, and Arizona.



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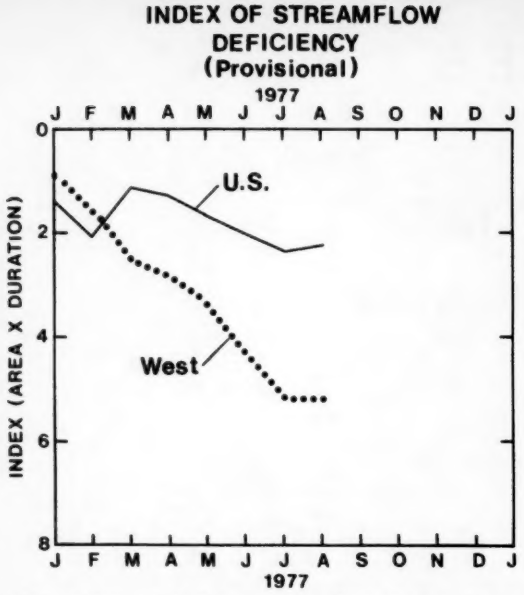


The index of deficient streamflow during August showed evidence that the worsening trend has abated. In the West the area affected by deficient streamflow has contracted slightly, and the downward course has slackened somewhat, standing at 5.2 in August as against 5.0 in July. In the rest of the country, areas of deficient streamflow are now interspersed with areas of excess, so that the national index of deficient flows improved from 2.4 in July to 2.2 in August. In the southeast, the area of deficient streamflows decreased substantially but persistent deficiency held the index at 1.4 in August compared to 1.5 in July. [Index = area of deficiency X monthly duration of deficiency.]

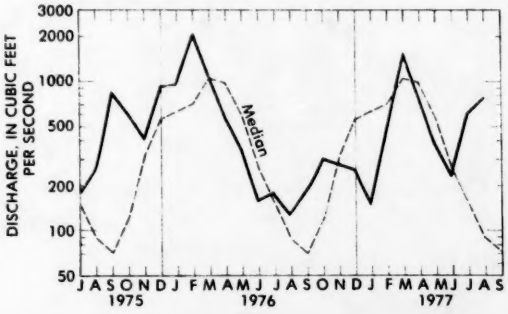
NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New Jersey, New York, Pennsylvania, and the New England States]

Streamflow generally continued to decrease seasonally except in parts of Maine, Massachusetts, New Jersey, New York, and Pennsylvania where contraseasonal increases occurred. Flows remained above the normal range in Nova Scotia and parts of Pennsylvania and increased into that range in parts of Maine, Massachusetts, New York and Vermont. Flows persisted in the below-normal range in parts of Maryland, New Jersey and New Brunswick.

Ground-water levels generally declined except for rises in northern Maine and parts of central and western New York. Levels near end of month were near or above average in most of the region. However, below-average levels persisted in New Jersey and Delaware.

In northwestern Pennsylvania, monthly mean discharge of Allegheny River at Natrona increased contraseasonally, was nearly 5 times the August monthly median, and remained in the above-normal range. Also, in Oil Creek at Rouseville (drainage area, 300 square miles), the monthly mean flow of 787 cfs was nearly 9 times the monthly median and highest for August in 45 years of record. (See graph.) Streamflows at the remaining index stations in the State responded seasonally and were in the normal range.



Monthly mean discharge of Oil Creek at Rouseville, Pa.
(Drainage area, 300 sq mi; 777 sq km)

In southern New Jersey, monthly mean flow in Great Egg Harbor River at Folsom increased contraseasonally to 49 percent of the monthly median but remained in the below-normal range for the 9th consecutive month. Elsewhere in the State, streamflows were near median and within the normal range.

In the extreme southern part of the region, in eastern Maryland, monthly mean discharge in Choptank River near Greensboro continued to decrease seasonally and remained below the normal range for the 7th consecutive month. Also in the southern part of the region, monthly mean flow in Potomac River near Washington, D.C. (drainage area, 11,560 square miles) continued to decrease seasonally, was about two-thirds the August median flow, and remained below the normal range for the 4th consecutive month. The monthly mean flow of 2,040 cfs was 2.3 times the minimum August flow of record that occurred in 1930.

In northern New York, flow at the index station, West Branch Oswegatchie River near Harrisville, increased contraseasonally to 243 percent of median and was above the normal range. On Long Island, the flow in Massapequa Creek at Massapequa decreased seasonally and was below the normal range after 5 consecutive months of flow in the normal range.

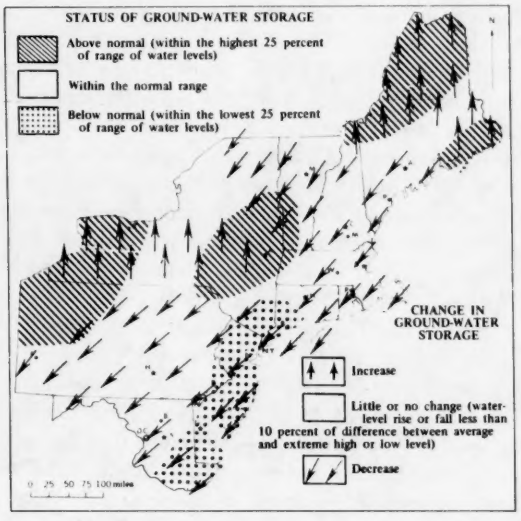
Monthly mean flows at the index stations in Connecticut, Rhode Island, Vermont, and New Hampshire generally decreased seasonally and were in the normal range. However, at Passumpsic River at Passumpsic, Vt. (drainage area, 436 square miles) streamflow increased sharply and the monthly mean flow of 626 cfs was the 2d highest August flow in record that began in October 1928. The daily flow of 4,260 cfs at Passumpsic exceeded the maximum previous daily high of 2,880 cfs that occurred in August 1933.

In Massachusetts, monthly mean discharge at Ware River at Coldbrook increased contraseasonally to over 200 percent of median and was in the above-normal range.

In Maine, streamflow generally decreased seasonally except in Piscataquis River near Dover-Foxcroft (in the central part of the State), where the monthly mean discharge increased contraseasonally to 233 percent of median and was in the above-normal range.

In Nova Scotia, mean flows at the index stations increased and remained in the above-normal range for the 3d consecutive month. Conversely, streamflow in New Brunswick decreased seasonally and in the northern part of the Province, flow in Upsalquitch River at Upsalquitch remained in the below-normal range for the 2d consecutive month.

Ground-water levels continued to decline seasonally in the southern half of the region as well as in most of New England other than northern Maine, where levels rose. (See map.) Levels rose also in much of central and western New York State. Levels near end of month were near or above average in most of the region. Exceptions, where below-average levels persisted, included most of New Jersey and Delaware and adjacent parts of western Connecticut, southeastern New York (other than Long Island, where levels were in the normal range), and eastern Maryland.



Map shows ground-water storage near end of August and change in ground-water storage from end of July to end of August.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow generally decreased seasonally in Tennessee and Virginia, increased in Georgia, Kentucky, and North Carolina, and was variable elsewhere in the region. Flows remained below the normal range in parts of Florida, North Carolina, South Carolina, and Virginia, and were lowest of record for the month in eastern North Carolina. Monthly mean discharge increased into the above-normal range in parts of Florida, Georgia, Kentucky, and South Carolina.

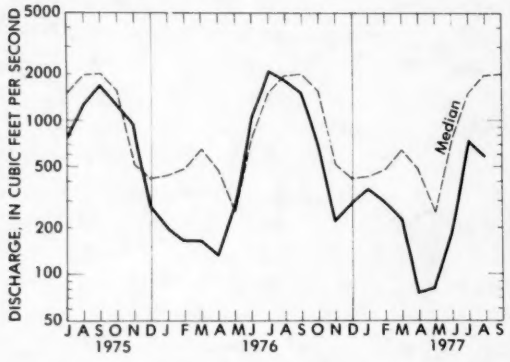
Ground-water levels showed mixed trends in West Virginia, Kentucky, and Georgia, generally rose in Florida, and declined in Virginia, North Carolina, and Mississippi. Levels were above average in Kentucky and Alabama, and below average in Virginia, Georgia, most of West Virginia, eastern North Carolina, and Florida. A new low for August was reported in Mississippi, and a new high in West Virginia. A new record low occurred in Tennessee.

In Neuse River basin, in the eastern Piedmont and Coastal Plain of North Carolina, mean flow at the index station near Clayton (drainage area, 1,140 square miles) increased contraseasonally as a result of increased runoff on the 19th, but remained in the below-normal range for the 5th consecutive month, and was only one-fourth of the August median flow. The daily mean of 53 cfs on August 14 was lowest for the month since records began in August 1927. In the adjacent basin of Cape Fear River, monthly mean flow at William O. Huske Lock near Tarheel increased seasonally, but remained below the normal range for the 4th consecutive month. In South Yadkin River basin, in the western Piedmont, the mean flow of 118 cfs at the index station near Mocksville (drainage area, 313 square miles) was 4th lowest for August in 46 years of record, and lowest for the month since 1956. In French Broad River basin, in the mountain area of western North Carolina, mean flow

at the index station at Asheville increased contraseasonally, as a result of runoff from rains near midmonth, and was in the normal range. In July, mean flow at this site was below the normal range and about one-half of median.

In northeastern South Carolina, mean flow in Lynches River at Effingham increased contraseasonally and was in the above-normal range, where it had been in 6 of the preceding 10 months. In the adjacent basin of Pee Dee River, the monthly mean discharge at Peedee increased seasonally, but remained below the normal range for the 4th consecutive month.

In west-central Florida, where flow in Peace River at Arcadia during August normally is greater than during July, monthly mean discharge decreased contraseasonally and remained below the normal range for the 5th consecutive month. (See graph.) By contrast, in extreme



Monthly mean discharge of Peace River at Arcadia, Fla.
(Drainage area, 1,367 sq mi; 3,541 sq km)

northwestern Florida, where August flow in Shoal River near Crestview normally is less than flow during July, monthly mean discharge increased contraseasonally, was twice the August median flow, and was above the normal range. In the northeastern part of the State, mean flow in Suwannee River at Branford increased seasonally but remained below the normal range.

In north-central Virginia, flow in Rapidan River near Culpeper continued to decrease seasonally and remained below the normal range for the 6th time in the past 7 months. The daily mean discharge of 20 cfs, on the 3d, was 2½ times the record-low daily mean discharge for August, in record that began in 1931. In the central part of the State, monthly mean flow in Slate River near Arvonia increased seasonally and was in the normal range, but was far below median for the month. In the extreme southwestern corner of the State, mean flow in North Fork Holston River near Saltville decreased sharply and was below median and in the normal range.

In the Potomac River basin in northern West Virginia and adjacent areas of Maryland and Virginia, flow of Potomac River at Paw Paw, W. Va., continued to decrease seasonally and remained in the normal range. In eastern West Virginia, mean flows in Greenbrier River at Alderson and Kanawha River at Kanawha Falls increased contraseasonally, were well above medians for the month, but remained within the normal range.

In Kentucky, increased runoff from thunderstorms near midmonth resulted in contraseasonal increases in monthly mean flows at the index stations, Green River at Munfordville and Licking River at Catawba. The mean discharges of 3,552 cfs at Munfordville (drainage area, 1,673 square miles) and 1,226 cfs at Catawba (drainage area, 3,300 square miles) were 6 and 3 times the respective August median flows at those two index stations.

In Georgia, where August median flows are less than those of July, monthly mean discharges increased contraseasonally at all index stations. In the northern part of the State, where rainfall during August generally was above normal, monthly mean flow in Oconee River near Greensboro increased sharply and was above the normal range, following 3 consecutive months of mean flows below that range. Elsewhere in the State, mean flows were near median.

In Alabama, Mississippi, and Tennessee, mean flows increased contraseasonally at some index stations and decreased seasonally at others, were less than median in Alabama, northeastern Mississippi, and north-central Tennessee, and above median elsewhere in the tri-State area.

Ground-water levels in West Virginia rose in most of the central and north-central third of the State, and declined elsewhere. Levels were above average in the north-central fourth of the State and below average elsewhere. The shallow index well at Glenville, in Gilmer County, rose 1.4 feet, was more than a foot above average, and reached a new high for August in 23 years of record. In Kentucky, levels declined seasonally except in areas of locally heavy rainfall, and in the Louisville–Jefferson County area, where levels rose slowly during the month; levels continued above average in most areas. The level in the Tyler well in the Piedmont of central Virginia declined more than a foot and was nearly 5 feet below average in more than 20 years of record. In western Tennessee, the 11th consecutive new monthly low, for the end of August, was reached in the key well in the "500-foot sand" near Memphis; this also was a new alltime low in 35 years of record. In North Carolina, levels declined Statewide; levels were above average in the mountains and western Piedmont, and below average in the eastern Piedmont and Coastal Plain. Levels in Mississippi generally declined. Record low levels were again established in wells screened in the Sparta Sand in the heavily-pumped Jackson metropolitan area. The

decline was about ½ foot—slightly less than last month. In Alabama, levels in the two key wells continued slightly above average. In Georgia, levels in most wells in the Piedmont were slightly lower than at the end of July, and ranged from 1 to 2 feet lower than a year ago. In the Savannah area, levels in wells in and near the center of pumping ranged from 1 to 2 feet higher than at the end of July, and were about 4 feet lower than a year ago. In the outlying areas, levels were about the same as at the end of July, and about 4 feet below a year ago. Levels in Bryan and Liberty Counties were slightly lower than at the end of July, and ranged from 1 to 3 ft lower than last year. In the Brunswick area farther south, levels in wells in and near the center of pumping ranged up to 5 ft higher than last month, and ranged from 3 to 6 ft lower than a year ago. In the outlying areas, levels were about 2 feet higher than July and about 3 feet lower than at the end of August 1976. The higher water level in Brunswick in comparison with last month can be attributed to a 2-week shutdown by one of the large industries prior to monthly water-level measurements. Levels rose in most areas of northern Florida during August. Compared with those of last month, levels ranged from 2.5 feet lower near Tampa to 3.6 feet above near Mulberry in west-central Polk County. End-of-month levels, below average at all stations reported, ranged from less than one foot below, north of Tallahassee, to 19.6 feet below near Mulberry. In southeast Florida, levels rose in most areas in response to seasonal rainfall. End-of-month levels were about 0.7 foot below average near Lake Worth in central-coastal Palm Beach County and about 0.3 foot above average north of Opa-locka in north-coastal Dade County. In southeast Dade County, in the Homestead area, levels were slightly below average.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow decreased seasonally in Minnesota, Ohio, and Wisconsin, but was variable elsewhere in the region. Flows remained in the below-normal range in Minnesota and in parts of Michigan and Wisconsin, and decreased into that range in eastern Ontario. Above-normal flows occurred in Indiana, and in parts of Illinois, Ohio, and Ontario. Flooding occurred in Indiana and Minnesota.

Ground-water levels generally declined in the region, but local rises occurred in Minnesota, Michigan, and Indiana. Levels were generally below average except in Illinois and Indiana. A new monthly low was reached in Michigan's Upper Peninsula.

In the Wabash River basin in west-central Indiana (Parke County), rapid runoff from intense rainfall (5 to 12 inches was observed by local residents between 2 p.m. and 9 p.m.) on August 6 resulted in severe flooding along small streams and damaged many culverts and bridges. Monthly mean discharge at the index station, Wabash River at Mount Carmel, Illinois, increased sharply, was twice the August median flow, and was above the normal range. Similarly, in eastern Indiana, mean flow in Mississinewa River at Marion increased sharply into the above-normal range and was 3 times the median flow for the month. Flow at that site was only about 20 percent of median in June and July. Also in the eastern part of the State, flow in East Fork White River at Shoals was above the normal range and twice the August median.

In east-central Illinois, monthly mean discharge in Sangamon River at Monticello increased sharply into the above-normal range and was 27 times the August median flow, as a result of runoff from intense thunderstorms near midmonth.

In northwestern Ohio, high carryover flow from July, augmented by above-normal runoff in August, resulted in monthly mean flow in Maumee River at Waterville that was more than twice the August median and was above the normal range. Similarly, in eastern Ohio, high carryover flow from July, augmented by increased runoff early in the month, held monthly mean flow in Little Beaver Creek near East Liverpool in the above-normal range.

In southeastern Ontario, east of Lake Huron, runoff from rains in Saugeen River basin near midmonth resulted in a sharp contraseasonal increase in flow at the index station near Port Elgin (drainage area, 1,530 square miles). Monthly mean discharge was 1,470 cfs and 2½ times the median discharge for August. In the eastern part of the Province, north of Lake Huron, monthly mean flow in Missinaibi River at Mattice decreased sharply, was about one-third of median, and was in the below-normal range for the 14th time in the past 16 months, emphasizing the continued lack of runoff-producing rainfall in that area.

In the northern part of Michigan's Lower Peninsula, south of Lake Huron, monthly mean flow in Muskegon River at Evart was below the normal range for the 11th time in the past 12 months, also emphasizing the continued lack of rainfall in that area. Farther south in that Peninsula, mean flow in Red Cedar River at East Lansing continued to decrease seasonally and remained

(Continued on page 7.)

Provisional data: subject to revision

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	August 31, 1977	Monthly mean, August		August		
		1977	1976	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	600.75	600.63	601.35	601.00	602.02 (1950)	599.15 (1926)
Michigan and Huron (Harbor Beach, Mich.)	578.45	578.52	580.30	578.64	580.99 (1973)	575.97 (1964)
St. Clair (St. Clair Shores, Mich.)	574.15	574.19	575.56	573.72	576.03 (1973)	571.60 (1934)
Erie (Cleveland, Ohio)	571.47	571.53	572.57	570.73	573.03 (1973)	568.36 (1934)
Ontario (Oswego, N.Y.)	245.04	245.08	246.27	245.13	247.45 (1947)	242.26 (1934)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	August 31, 1977	August 31, 1976	Reference period 1904–76		
			August average, 1904–76	August maximum (year)	August minimum (year)
Elevation in feet above mean sea level:	4,199.25	4,200.70	4,198.0	4,204.1 (1923)	4,191.65 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

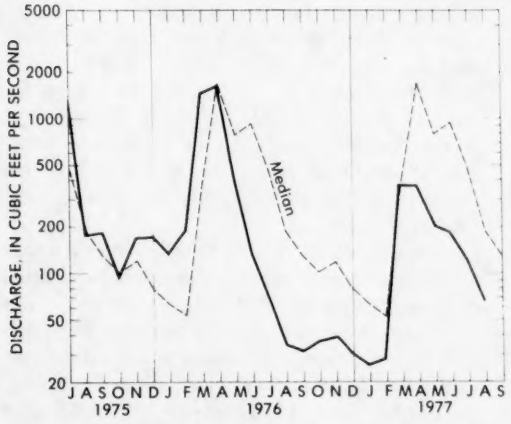
Alltime high (1827–1975): 102.1 (1869). Alltime low (1939–1975): 92.17 (1941).	August 30, 1977	August 31, 1976	Reference period 1939–75		
			August average, 1939–75	August max. daily (year)	August min. daily (year)
Elevation in feet above mean sea level:	94.90	97.78	94.96	97.93 (1972)	93.39 (1949)

FLORIDA

Site	August 1977		July 1977	August 1976
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	650	83	700	780
Miami Canal at Miami (southeastern Florida)	247	78	203	234
Tamiami Canal outlets, 40-mile bend to Monroe	187	44	162	493

(Continued from page 5.)
below the normal range and at about one-half of median for the 3d consecutive month. In the Upper Peninsula, monthly mean discharge in Sturgeon River at Sidnaw also decreased seasonally and was about one-half of median, but was in the normal range.

In Minnesota, urban flooding occurred August 31 in the Minneapolis-St. Paul area as a result of rapid runoff from 7.36 inches of rainfall, reportedly observed by the National Weather Service at the airport rain gage. Monthly mean flows continued to decrease seasonally and were below the normal range for the 15th time in the past 16 months at all index stations in the State. In central Minnesota, mean flow in Crow River at Rockford was representative of the pattern of flows elsewhere in the State. (See graph.) In the southwestern part of the



Monthly mean discharge of Crow River at Rockford, Minn. (Drainage area, 2,520 sq mi; 6,530 sq km)

State, the mean flow of 424 cfs in Minnesota River near Jordan (drainage area, 16,200 square miles) was the 3d lowest for August since records began in September 1934.

In west-central Wisconsin, mean flow in Wisconsin River at Muscoda continued to decrease seasonally and remained below the normal range for the 15th consecutive month. In the east-central part of the State, monthly flow in Fox River at Rapide Croche Dam, near Wrightstown, also decreased seasonally and was below the normal range for the 14th time in the past 15 months, and in northeastern Wisconsin, mean flow in Oconto River near Gillett was in the below-normal range for the 13th time in the past 14 months.

Ground-water levels in shallow water-table wells in Minnesota declined in the southern part of the State and remained about the same in the northern part; levels continued below average. The level in the key well near Hanska, in Brown County in south-central Minnesota declined nearly 2 feet and although more than 5 feet below average, was 4¼ feet above the level of a year ago. In the Minneapolis-St. Paul area, artesian levels rose in wells tapping the Prairie du Chien-Jordan aquifer and in the deeper Mt. Simon-Hinckley aquifer; both were below average. Levels declined seasonally in Wisconsin and continued below average. In Michigan, levels continued to decline generally, but rose in shallow wells in some areas, and all were below average. A new monthly low was reached in the well in glacial drift near Ishpeming in the western part of the Upper Peninsula. In northwestern Illinois, the level in the shallow index well in glacial drift at Princeton, in Bureau County, declined about ½ foot, but was $2\frac{2}{3}$ feet above average. Levels in eastern Indiana rose $\frac{1}{3}$ foot, reversing the usual seasonal decline in August. Levels in central and northeastern Ohio declined slightly but were within the normal range.

MIDCONTINENT

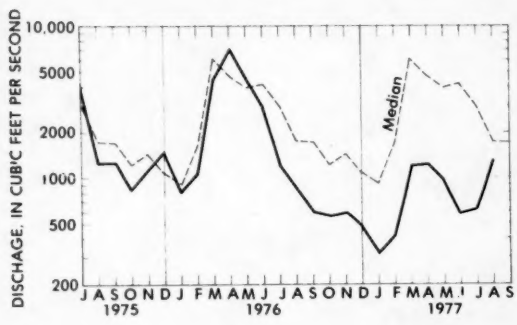
[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow generally increased in Arkansas, Iowa, Kansas, and Louisiana, decreased in Manitoba, Saskatchewan, North Dakota, Oklahoma, and Texas, and was variable elsewhere in the region. Flows remained below the normal range in parts of Iowa, Louisiana, and North Dakota, and were lowest of record for the month in parts of Iowa. Mean flows remained in the above-normal range in part of Texas, increased into that range in parts of Arkansas, Kansas, and Nebraska, and were highest of record for the month in parts of the latter two States. Flooding occurred in Iowa and Nebraska.

Ground-water levels showed mixed trends in the region, but levels generally declined in North Dakota and generally rose in Iowa, holding steady in Kansas. A new monthly low was reached in North Dakota, and new alltime lows in Kansas and Texas; new monthly highs occurred in Iowa, and a new alltime high occurred in Texas.

In central Iowa, between Ames and Marshalltown, rapid runoff from an intense thunderstorm on the 15th resulted in flooding along Timber and Richland Creeks. Peak discharges on those streams were equivalent to those of a 100-year flood. In the west-central part of the State, monthly mean flow in Des Moines River at Fort

Dodge (drainage area, 4,190 square miles) continued to decrease seasonally, was only 30 percent of median, and remained below the normal range for the 17th consecutive month. The daily mean discharge of 46 cfs on the 6th and 7th was lowest for the month in 45 years of record. Elsewhere in the State, flows increased contraseasonally and were in the normal range. Flow in Cedar River at Cedar Rapids was normal for the first month since June 1976. (See graph.)



Monthly mean discharge of Cedar River at Cedar Rapids, Iowa
(Drainage area, 6,510 sq mi; 16,861 sq km)

In northwestern Nebraska, flash flooding occurred in Niobrara River on the 17th. The peak discharge of 1,650 cfs at the gaging station at Wyoming – Nebraska State line (drainage area, 450 square miles) was the greatest since records began in October 1955. The previous maximum discharge was 800 cfs, July 17, 1969. Downstream, at the index station, Niobrara River above Box Butte Reservoir (drainage area, 1,400 square miles), the monthly mean discharge of 32.6 cfs, and the daily mean of 457 cfs on the 17th, were highest for the month since records began in October 1946. The daily mean of 457 cfs was the 2d highest for any day in that period of record. Elsewhere in the State, streamflow generally was in the normal range.

In the Red River of the North basin, in eastern North Dakota and the adjacent area of western Minnesota, monthly mean flow at Grand Forks, N. Dak., decreased seasonally, was below the normal range for the 15th time in the past 16 months, and was only 19 percent of median. In the southwestern part of the State, mean flow in Cannonball River at Breien decreased sharply, was only 17 percent of median, and was in the below-normal range.

In southeastern Saskatchewan, monthly mean flow in Qu'Appelle River near Lumsden continued to decrease seasonally and was less than one-half median, but remained within the normal range.

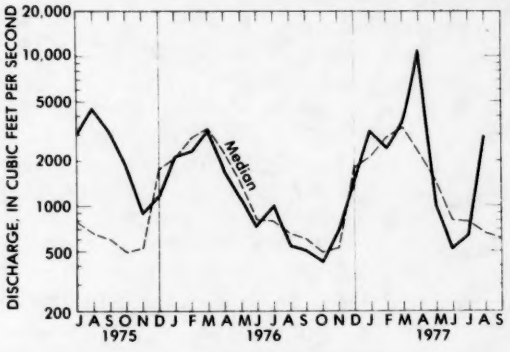
In southern Manitoba, mean flow in Waterhen River below Waterhen Lake also decreased seasonally and remained in the normal range for the 11th consecutive month. The level of Lake Winnipeg at Gimli averaged 711.83 feet above mean sea level, 0.07 foot higher than last month, 0.10 foot lower than a year ago, and 2.33 feet lower than the August long-term mean.

Runoff from unseasonably heavy rainfall in Kansas resulted in sharp increases in streamflow. In north-central Kansas, the monthly mean flow of 2,499 cfs in Little Blue River near Barnes (drainage area, 3,324 square miles) was highest for the month since August 1928, was 8 times the median flow for the month, and was above the normal range for the first time since April 1976. Mean flow there during July was 269 cfs and was only one-half of median for that month. In the western part of the State, mean flow in Saline River near Russell was greater than median for the first time since March 1976, increasing from 4 percent of median in July to 511 percent of median in August. In the southwestern part of the State, flow in Arkansas River at Arkansas City increased into the above-normal range and was 3 times the median flow for the month.

In northern Arkansas, where flow in Buffalo River near St. Joe normally is less in August than in July, mean flow increased contraseasonally, from less than one-half median in July to about 3 times median in August, and was above the normal range. In the southern part of the State, mean flow in Saline River near Rye also increased contraseasonally, but remained within the normal range.

In south-central Texas, monthly mean discharge in Guadalupe River near Spring Branch continued to decrease seasonally, but remained above the normal range as a result of high carryover flow from July and a high rate of seepage inflow from ground-water storage. In the San Antonio River basin, mean flows were below the normal range downstream from the Balcones Fault Zone. Elsewhere in the State, streamflow continued to decrease and was in the normal range.

In southeastern Louisiana, monthly mean discharge in Amite River near Denham Springs (drainage area, 1,280 square miles), increased contraseasonally as a result of runoff from rains late in the month, was about 5 times the August median flow, and was in the above-normal range. (See graph.) The daily mean discharge of 16,600



Monthly mean discharge of Amite River near Denham Springs, La.
(Drainage area, 1,280 sq mi; 3,315 sq km)

cfs on the 26th was highest for the month in 39 years of record. In the northwestern part of the State, mean flow in Saline Bayou near Lucky decreased seasonally and was in the below-normal range for the 3d time in the past 4 months.

In Missouri, Oklahoma, and South Dakota, flows generally were variable, and were in the normal range at all index stations.

Ground-water levels in North Dakota generally declined and continued much below normal in most parts of the State. The level in the water-table well at Wyndmere, in eastern North Dakota, reached a new low for August—the fourth consecutive monthly low at this well. In Nebraska, levels generally rose and were above average in most parts of the State except in the Panhandle region and in areas where there is large-scale development of ground water for municipal and irrigation supplies. In Iowa, levels in shallow water-table wells rose State-wide in response to several heavy rains and numerous scattered showers. The level in the shallow well in glacial drift in Linn County in eastern Iowa, which was at a new low for July last month, rose 5¼ feet, was nearly 3 feet above the average for August in 35 years of record, reaching a new high for the month. New monthly highs were recorded also in Johnson, Clayton and Page Counties. Levels held fairly steady in Kansas, owing to above-normal precipitation. However, even with adequate rainfall, water-mining in northwestern Kansas resulted in a new alltime low in 30 years of record in the observation well in Colby, in Thomas County. In Arkansas, in the rice-growing area in the east-central part of the State, the level in the shallow aquifer declined slightly, but was in the normal range. The level in the deep Sparta Sand aquifer continued to decline——8½ feet since the end of July——reflecting the rice-growing season. The end-August level was 58½ feet below average but 16½ feet above the lowest of record——that for August, 1976. In the industrial aquifer of central and southern Arkansas——also the Sparta Sand——the level in the key well at Pine Bluff declined, and was 11¼ feet below average and 4 feet lower than a year ago. At El Dorado, the level rose 1¼ feet and was ½ foot higher than a year ago. In Louisiana, levels rose rapidly in the Chicot aquifer in the southwestern part of the State, following the end of the rice irrigation season. The average water-level rise during August was about 10 feet in the parishes of Jefferson Davis and Acadia, where heavy irrigation pumping occurred. Water levels in index wells in the other major aquifers changed little——generally less than ½ foot. In Texas, levels declined at Austin, San Antonio, and El Paso, but rose at Houston. Levels were above average in the Edwards Limestone at Austin and San Antonio, but below average in the bolson deposits at El Paso. New high levels for August were recorded at Austin and Houston; the level at Houston was also an alltime high. A new alltime low was recorded at El Paso in the well in the bolson deposits in the El Paso mesa area.

WEST

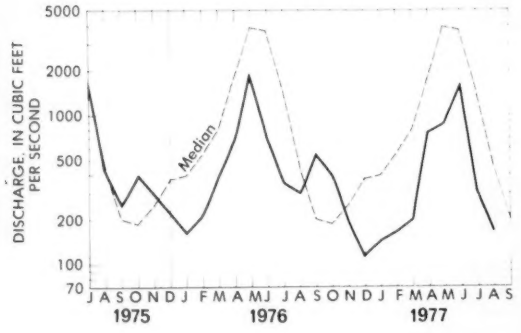
[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow generally decreased seasonally except in Arizona and parts of Colorado, Idaho, Montana, New Mexico, Utah, and Washington. Monthly and daily mean flows were lowest of record for the month in parts of California, Colorado, Idaho, and Utah. Flows remained below the normal range in parts of each State except Arizona. Above-normal flows persisted in part of Arizona and increased into that range in southwestern New Mexico. Flooding occurred in southern California and in parts of Colorado and Utah.

Ground-water levels showed mixed trends in the region, but declines in levels were predominant except in Idaho. Levels were mostly below average; new lows for August occurred in Washington, Montana, southern California, and Nevada. Once again, three new alltime lows were recorded in Arizona.

In southern California, tropical storm Doreen on Aug. 16–18 dumped heavy rains on the coast, mountains, and deserts. Imperial County, hit by a massive storm less than a year ago, was battered anew. Water rushing through a break in the Highline Canal, in the northeast part of the county, caused heavy property, crop and road damage. Flood waters tore out Interstate Highway 8 at Octillo and State Highway 86 along the west shore of Salton Sea. State Highway 78 was closed between Julian and Borrego by slides, flooding, and undermining. Runoff was heaviest in the Octillo-Westmoreland area and in the Borrego Desert with the Mojave and Amargosa Rivers also experiencing high runoff. In Borrego Palm Creek near Borrego Springs (drainage area, 21.8 square miles), the peak discharge was 3,000 cfs, the greatest discharge observed there since records began in 1950. The storm provided some relief from fires in southern California but the effect of the overall extreme drought was unchanged since most of the critical areas are in northern California. For example, in Kings River above North Fork, near Trimmer, considered indicative

of the flow from the southern part of the Sierra Nevada into Central Valley, the monthly mean discharge of 165 cfs and the daily mean of 110 cfs were lowest for August in 48 years of record. (See graph.) The previous August



Monthly mean discharge of Kings River above North Fork, near Trimmer, Calif. (Drainage area, 952 sq mi; 2,466 sq km)

minimums were 176 cfs (monthly) and 110 cfs (daily), recorded in 1960. Flows near Trimmer have been below the normal range for 9 consecutive months. In northern California, also in the Sierra Nevada west slope, the monthly mean discharge of 12.4 cfs in North Fork American River at North Fork Dam (drainage area, 342 square miles), was 6 cfs less than the previous record low August mean that occurred in 1931 and remained in the below-normal range for the 11th consecutive month. In the north-coastal basin of Smith River, mean flow at the index station near Crescent City continued to decrease seasonally and remained below median flows for the 11th consecutive month and below the normal range for the 3d consecutive month. The cumulative runoff for the first 11 months of this water year (October 1976 through September 1977) at North Fork Dam, Crescent City, an ' Trimmer were 12, 24, and 34 percent, respectively, of their 30-year medians (1941–70). The extremely low runoff at these index stations illustrates the severe effect the drought has had on water supply. Similarly, on the central Sierra Nevada east slope, monthly mean flow of West Walker River below Little Walker River, near Coleville (drainage area, 180 square miles) continued to decrease seasonally and remained below the normal range for the 10th consecutive month with the daily mean of 13 cfs on the 31st––the lowest in 39 years of record. The monthend contents of major reservoirs in northern California were only 32 percent of average and 49 percent of those of a year ago.

In Nevada, streamflow at the index station, Humboldt River at Palisade, continued to decrease seasonally, but was in the normal range after 6 consecutive months of below-normal flows.

In eastern Oregon, monthly mean discharge in John Day River at Service Creek continued to decrease seasonally and remained below the normal range for the 10th consecutive month at only 24 percent of median. In southwestern Oregon, mean flow in Umpqua River near Elkton also decreased seasonally and was below the normal range for the 9th time in the past 10 months. In the western part of the State, mean flow in Willamette River at Salem decreased seasonally and remained below the normal range at 61 percent of median.

In the lowland streams of western Washington, streamflow generally declined seasonally until Aug. 24 when above-average precipitation caused significant increases in flow. For example, the monthly mean flow of 282 cfs at Chehalis River near Grand Mound (drainage area, 895 square miles) was just slightly above the normal range at 128 percent of median. Streams with their headwaters at higher elevations generally had flows within the normal range. In the eastern part of the State, streamflow continued to decrease seasonally in Spokane River at Spokane and remained below the normal range for the 10th consecutive month at 49 percent of median. Monthend storage in major reservoirs was near average.

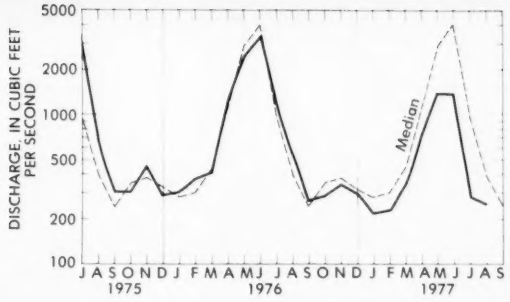
Monthly mean flows at the index stations in Alberta and British Columbia generally decreased seasonally and were within the normal range.

Streamflow in Idaho generally decreased seasonally and was below the normal range. Monthly mean flows at Snake River near Heise (adjusted for storage) and Salmon River at White Bird remained below the normal range for the 7th consecutive month. The mean flow in Coeur d'Alene River at Enaville was the lowest in 58 years of record. Reservoir storage for irrigation in southern Idaho was less than 30 percent of average.

In Montana, streamflow continued to decrease seasonally in the Yellowstone and Clark Fork basins and remained in the below-normal range for the 4th and 8th consecutive months, respectively, in those basins. In the northwestern part of the State, monthly mean flow in Marias River near Shelby increased contraseasonally to 72 percent of median and was within the normal range in August after 5 consecutive months of flows in the below-normal range.

In northern Wyoming, monthly mean discharge in Tongue River near Dayton continued to decrease seasonally and remained below the normal range for the 3d consecutive month at 72 percent of median. In the south-central part of the State, mean flow in North Platte River above Seminoe Reservoir, near Sinclair, also decreased seasonally and remained below the normal range for the 8th consecutive month. (See graph on page 11.)

In central Colorado, east of the Continental Divide, the monthly mean discharge of 187 cfs, and the daily



Monthly mean discharge of North Platte River above Seminoe Reservoir, near Sinclair, Wyo. (Drainage area, 8,134 sq mi; 21,067 sq km)

mean of 106 cfs on the 3d, in Arkansas River at Canon City (drainage area, 3,117 square miles) were lowest for the month in 89 years of record. The previous August minimums were 262 cfs (monthly) in 1931 and 144 cfs (daily) in 1896. Also in central Colorado but west of the Divide, monthly mean flow in Roaring Fork River at Glenwood Springs decreased seasonally and remained below the normal range for the 7th consecutive month. Also west of the Divide, mean flow in Yampa River at Steamboat Springs increased contraseasonally but remained below the normal range for the 10th consecutive month. Some flash flooding occurred in the Louviers area (south of Denver), on Aug. 10 as a result of locally heavy rains.

In Utah, streamflow during August improved as a result of several storms during the month but remained below the normal range at all index stations except Whiterocks River near Whiterocks and San Juan River near Bluff. In the southwestern part of the State, the monthly mean discharge of 11.6 cfs and the daily mean of 9.6 cfs on the 10th, in Beaver River near Beaver (drainage area, 90.7 square miles), were lowest for the month since records began in March 1914. Flows in Beaver River have been below the normal range for 18 consecutive months. In northern Utah, mean flow in Weber River near Oakley continued to decrease seasonally, was 50 percent of median, and remained below the normal range for the 12th consecutive month. During the period August 14–20, remnants of hurricane Doreen, with its moisture-laden Pacific airmass, moved into Utah and dropped record rainfall on areas in and near Cache Valley. The storm caused local flooding with some damage to roads and basements, but in general was very beneficial to agriculture.

In New Mexico, streamflow was below the normal range in the Upper Rio Grande basin. In the Gila River basin, in the southwestern corner of the State, mean flow at the index station near Gila increased sharply, was over two times the median and above the normal range.

In adjacent southeastern Arizona, streamflow in Gila River at head of Safford Valley, near Solomon, also increased and remained above the normal range at 2½ times the monthly median. Elsewhere in the State, streamflow generally increased seasonally at the index stations and was in the normal range.

Contents of the Colorado River Storage Project decreased 988,270 acre-feet during the month.

Ground-water levels in Washington declined in the western part of the State and rose in the east, but with continuing below-average levels; the level in the key well in Spokane, despite a ¾-foot rise, was at a new low for August in 34 years of record. In Idaho, the level in the well in the sand and gravel aquifer in the Boise Valley held steady and was more than a foot above average. The key wells in the Snake River Plain aquifer rose but continued below average, except in the well at Atomic City, where the level declined slightly and continued below average. The level in the well in the alluvial aquifer of the Rathdrum Prairie in northern Idaho declined more than ½ foot and was nearly 9 feet below average. In western Montana, the levels in the terrace gravel wells at Missoula and Hamilton declined and continued below average, with a new August low in the Missoula well. In southern California, levels in selected observation wells declined except in the well in the Lompoc area, in Santa Ynez Valley, Santa Barbara County, which rose 2⅔ feet; all continued below average, and a new August low was reached in the water-table well in Upper Cuyama Valley, Santa Barbara County. In Nevada, the artesian levels in the Las Vegas and Steptoe Valley wells declined; a new monthly low was reached in the former, but in the latter the level was above average despite its decline during the month. The artesian level rose in the Truckee Meadows well, but was at a new August low at the end of the month. The level in the water-table well in Paradise Valley declined and continued below average. In Utah, artesian levels rose in the Logan and Holladay areas and declined in the Flowell and Blanding areas; levels were below average. The level in the Blanding observation well was below average for the first time during this water year. Mixed trends occurred in Arizona, but levels generally continued below average. Again, three alltime lows were measured, including those in the Tucson and Elfrida water-table observation wells. In New Mexico, levels generally declined and continued below average. However, levels in the artesian Berrendo-Smith well in the Roswell artesian basin, and in the water-table wells, Hrna in the Mimbres Valley and Dayton in the southern part of the Roswell basin, all were about 3 feet above the levels of August 1976.

Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR AUGUST AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	August data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum	Maximum	Mean, in °C	Minimum, in °C	Maximum, in °C
						(tons per day)					
	NORTHEAST										
01463500	Delaware River at Trenton, N.J.	1977	3,700	102	125	1,070	845	1,245	25.0	22.5	27.5
	(Morrisville, Pa.)	1945–76 (Extreme yr)	6,472 [4,268[c]]	67 (1945)	158 (1967)	.....	505 (1965)	21,500 (1955)	.....	17.5	31.5
04264331	St. Lawrence River at Cornwall, Ontario, near	1977	260,000	166	167	117,000	113,000	120,000	21.5	20.0	22.5
		1976	326,000	166	167	146,000	141,000	153,000	20.0	19.0	20.5
	Massena, N.Y. (streamflow station formerly at Ogdensburg, N.Y.)	1966–76	282,400 [252,000[c]]	.....	.....	.....	.....	.....	22.0	19.0	24.5
	SOUTHEAST										
07289000	Mississippi River at Vicksburg, Miss	1977	309,600	213	244	196,000	118,000	271,000	30.0	28.0	31.0
		1976	280,000 [317,600[c]]	238	260	198,000	163,000	226,000	28.5	27.5	30.5
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill.	1977	165,900	184	339	.....	41,900	241,000	.....	27.0	30.0
	(25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)	1955–76 (Extreme yr)	128,700 [102,200[c]]	128 (1963)	321 (1969)	.....	20,300 (1965)	246,000 (1958)	.....	17.0	30.5
	MIDCONTINENT										
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1977	57,600	295	436	56,300	43,000	90,100	26.0	25.0	29.5
		1976	46,800 [55,620[c]]	360	433	51,800	46,900	58,400	27.0	25.0	29.5
	WEST										
14128910	Columbia River at Warrendale, Oreg.	1977	94,120	95	100	25,500	15,500	33,000	21.5	20.0	22.0
		1976	227,700	71	78	46,300	28,700	52,500	19.0	18.5	19.5
	(30 miles east of Portland, Oreg.; streamflow station at The Dalles, Oreg.)	1968–76	154,100 [153,200[c]]	.....	.....	.....	.....	.....	.....	18.5	22.5

[a] Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b] To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c] Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF AUGUST 1977

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of July 1977	End of Aug. 1977	End of Aug. 1976	Average for end of Aug.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	79	71	64	48	226,300 (a)
QUEBEC					
Allard (P)	89	79	90	67	280,600 ac-ft
Gouin (P)	96	81	90	66	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	85	75	94	67	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	87	87	85	84	3,330 mcf
Lake Francis (FPR)	81	79	77	82	4,326 mcf
Lake Winnipesaukee (PR)	93	83	87	74	7,200 mcf
VERMONT					
Harriman (P)	78	72	72	70	5,060 mcf
Somerset (P)	80	71	80	77	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	80	75	82	78	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	83	66	79	71	34,270 mcf
Indian Lake (FMP)	90	100	100	72	4,500 mcf
New York City reservoir system (MW)	86	76	90	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	76	63	89	75	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	47	47	44	41	51,400 mcf
Pymatuning (FMR)	100	101	89	86	8,191 mcf
Raystown Lake (FR)	68	67	67	52	33,190 mcf
Lake Wallenpaupack (PR)	71	64	68	64	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	86	80	95	88	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	86	82	93	88	12,580 mcf
Narrows (Badin Lake) (P)	96	96	96	99	5,617 mcf
High Rock Lake (P)	65	60	80	74	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	82	78	87	71	70,300 mcf
Lakes Marion and Moultrie (P)	71	70	79	67	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	63	62	75	66	75,360 mcf
GEORGIA					
Burton (PR)	90	89	91	86	104,000 ac-ft
Sinclair (MPR)	82	90	85	86	214,000 ac-ft
Lake Sidney Lanier (FMPR)	59	53	60	59	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	90	86	93	85	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	48	42	44	46	1,156,000 cfsd
Douglas Lake (FPR)	45	31	45	47	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	77	68	78	68	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	54	46	52	53	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	72	63	72	68	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	77	71	69	75	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	47	48	31	64	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	24	19	21	35	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	80	78	94	.....	22,640,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	59	59	65	77	127,600 ac-ft
Bell Fourche (I)	23	23	16	39	185,200 ac-ft
Lake Francis Case (FIP)	72	73	77	77	4,834,000 ac-ft
Lake Oahe (FIP)	79	75	84	.....	22,530,000 ac-ft

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of July 1977	End of Aug. 1977	End of Aug. 1976	Average for end of Aug.	Normal maximum
	Percent of normal maximum				
MIDCONTINENT REGION--Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	101	103	103	99	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	95	96	95	96	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	67	63	64	68	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	94	89	79	78	2,378,000 ac-ft
Keystone (FPR)	102	109	75	88	661,000 ac-ft
Tenkiller Ferry (FPR)	95	95	93	90	628,200 ac-ft
Lake Altus (FIMR)	81	70	59	47	134,500 ac-ft
Lake O'The Cherokees (FPR)	94	85	85	83	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	98	96	92	92	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	91	85	84	45	386,400 ac-ft
Canyon (FMR)	92	90	93	72	385,600 ac-ft
International Amistad (FIMPW)	100	101	100	69	3,497,000 ac-ft
International Falcon (FIMPW)	96	87	93	63	2,667,000 ac-ft
Livingston (IMW)	100	94	97	77	1,788,000 ac-ft
Possum Kingdom (IMPRW)	94	92	89	100	569,400 ac-ft
Red Bluff (PI)	13	9	21	23	307,000 ac-ft
Toledo Bend (P)	96	86	90	82	4,472,000 ac-ft
Twin Buttes (FIM)	89	82	88	17	177,800 ac-ft
Lake Kemp (IMW)	84	76	61	85	268,000 ac-ft
Lake Meredith (FMW)	36	39	38	42	821,300 ac-ft
Lake Travis (FIMPRW)	92	84	94	74	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	66	78	99	95	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	94	100	97	98	5,232,000 ac-ft
Lake Chelan (PR)	87	87	99	94	676,100 ac-ft
Lake Cushman	77	79	100	97	359,500 ac-ft
Lake Merwin (P)	106	107	106	102	246,000 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	32	18	65	58	1,235,000 ac-ft
Coeur d'Alene Lake (P)	98	90	99	73	238,500 ac-ft
Pend Oreille Lake (FP)	100	98	99	100	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	31	16	60	56	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	64	62	92	87	802,000 ac-ft
Buffalo Bill (IP)	61	52	90	90	421,300 ac-ft
Keyhole (F)	68	60	73	44	199,900 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	52	44	63	47	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	0	0	0	17	364,400 ac-ft
Taylor Park (IR)	57	50	72	78	106,200 ac-ft
Colorado--Big Thompson project (I)	34	29	59	64	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	68	65	82	.....	31,280,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	60	56	86	62	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	24	17	47	68	1,000,000 ac-ft
Hetch Hetchy (MP)	41	37	43	68	360,400 ac-ft
Isabella (FIR)	10	7	13	30	551,800 ac-ft
Pine Flat (FI)	15	7	20	40	1,014,000 ac-ft
Clair Engle Lake (Lewiston) (P)	23	14	70	82	2,438,000 ac-ft
Lake Almanor (P)	64	59	60	54	1,036,000 ac-ft
Lake Berryessa (FIMW)	52	49	67	81	1,600,000 ac-ft
Millerton Lake (FI)	42	38	38	41	503,200 ac-ft
Shasta Lake (FIPR)	16	13	31	72	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	19	6	48	63	744,600 ac-ft
NEVADA					
Rye Patch (I)	42	37	76	84	157,200 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	75	75	77	71	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	0	0	0	12	1,073,000 ac-ft
Salt and Verde River system (IMPR)	30	26	51	37	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	23	34	24	81	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	8	6	14	24	2,539,000 ac-ft

[a]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

FLOW OF LARGE RIVERS DURING AUGUST 1977

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	August 1977					
				Monthly discharge (cfs)	Percent of median monthly discharge, 1941–70	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	4,360	126	-9	4,000	2,600	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,791	1,182	108	+80	2,720	1,760	26
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,450	1,900	132	+16	.....	.....	.....
1–4635	Delaware River at Trenton, N.J	6,780	11,360	3,777	88	-6	3,790	2,450	25
1–5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	11,270	148	-32	7,970	5,150	31
1–6465	Potomac River near Washington, D.C.	11,560	[1] 10,640	2,040	67	-17	1,800	1,160	31
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	1,226	41	+85	580	370	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,098	3,540	58	+19	2,420	1,560	28
2–2260	Altamaha River at Doctortown, Ga.	13,600	13,380	5,990	96	+65	5,020	3,240	29
2–3205	Suwannee River at Branford, Fla	7,740	6,775	2,950	55	+4	3,920	2,530	30
2–3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	11,720	82	+14	11,700	7,560	31
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	4,532	95	+3	4,950	3,200	27
2–4895	Pearl River near Bogalusa, La	6,630	8,533	3,369	122	+40	1,840	1,190	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 18,700	22,460	478	+15	22,700	14,700	24
3–0850	Monongahela River at Braddock, Pa.	7,337	[1] 11,950	6,516	157	+50	4,550	2,940	24
3–1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	5,804	138	+43	6,740	4,360	27
3–2345	Scioto River at Higby, Ohio	5,131	4,337	993	110	-17	920	590	26
3–2945	Ohio River at Louisville, Ky[2]	91,170	110,600	73,880	247	+35	53,000	34,300	28
3–3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	19,350	227	+99	36,600	23,700	26
3–4690	French Broad River below Douglas Dam, Tenn.	4,543	[1] 6,528	3,170	101	-9	.....	.....	.....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,142	1,400	64	-18	.....	.....	.....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	299,000	239,100	259,700	103	+4	266,000	172,000	31
050115	St. Maurice River at Grand Mere, Quebec.	16,300	24,900	15,600	98	-2	18,500	12,000	31
5–0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,439	233	19	-60	200	130	31
5–3300	Minnesota River near Jordan, Minn	16,200	3,306	424	23	-54	442	286	25
5–3310	Mississippi River at St. Paul, Minn	36,800	[1] 10,230	1,868	26	-52	1,350	870	24
5–3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	2,225	78	-27	.....	.....	.....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,457	3,223	65	-17	.....	.....	.....
5–4465	Rock River near Joslin, Ill	9,520	5,288	3,470	125	+28	3,000	1,900	31
5–4745	Mississippi River at Keokuk, Iowa	119,000	61,210	33,641	88	+5	32,500	21,000	31
5–4855	Des Moines River below Raccoon River at Des Moines, Iowa.	9,379	3,796	1,177	77	+970	2,000	1,300	31
6–2145	Yellowstone River at Billings, Mont.	11,795	6,754	2,649	50	-43	2,130	1,380	31
6–9345	Missouri River at Hermann, Mo	528,200	78,480	57,090	103	-26	52,000	33,600	26
7–2890	Mississippi River at Vicksburg, Miss.[4]	1,144,500	552.700	309,600	97	-16	388,000	251,000	31
7–3310	Washita River near Durwood, Okla	7,202	1,379	307	85	-27	500	320	31
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex.	9,730	732	198	67	-1	190	120	31
9–3150	Green River at Green River, Utah	40,600	6,369	1,153	38	+2	2,500	1,600	31
11–4255	Sacramento River at Verona, Calif	21,257	18,370	6,613	77	-10	6,850	4,430	29
13–2690	Snake River at Weiser, Idaho	69,200	17,670	7,024	65	+30	9,400	6,080	29
13–3170	Salmon River at White Bird, Idaho	13,550	11,060	3,309	61	-37	3,660	2,370	29
13–3425	Clearwater River at Spalding, Idaho	9,570	15,320	4,585	128	-40	8,470	5,470	28
14–1057	Columbia River at The Dalles, Oreg.[5]	237,000	194,000	107,100	76	-7	.....	.....	.....
14–1910	Willamette River at Salem, Oreg	7,280	23,370	2,451	61	-35	7,630	4,930	27–31
15–5155	Tanana River at Nenana, Alaska	25,600	24,040	60,900	117	+20	.....	.....	.....
8MF005	Fraser River at Hope, British Columbia.	83,800	95,300	129,000	108	-24	109,000	70,400	30

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.
*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

ALASKA

Streamflow was variable throughout the State and was affected by differences in snowpack, less-than-normal precipitation, and above-normal temperatures. In Gold Creek basin in southeastern Alaska, where precipitation was reported to be only 40 percent of normal and where several daily maximum temperatures of record were exceeded during the month, increased snowmelt runoff from higher elevations resulted in a contraseasonal increase in monthly mean flow at the index station near Juneau. Similarly, in the higher mountain drainages of the coastal streams of south-central Alaska, where record snowpack occurred last winter, the monthly mean discharge of 11,561 cfs in Kenai River at Cooper Landing (drainage area, 634 square miles) was highest for August in record that began in 1947, and was above the normal range for the 9th time in the past 11 months. Monthly mean flows at this station have been highest of record (for the respective months) in 6 of those months, and total runoff for the 1977 water year is expected to be the maximum in the period of record. In south-central Alaska, flow in the low-elevation basin of Susitna River near Palmer decreased sharply as a result of reduced melt-water runoff from the diminished snowpack, and was below the normal range. In the interior, mean flow in Chena River at Fairbanks decreased contraseasonally and was below the normal range because of lack of snowmelt runoff, but in the adjacent basin of Tanana River, mean discharge at Nenana increased contraseasonally as a result of increased glacial melt-water runoff caused by above-normal temperatures.

Ground-water levels in the Anchorage area generally rose 2 feet or more in the confined aquifer. However, there was a decline in water level near one pumping center located at the North Fork Campbell Creek fan in southeast Anchorage. Levels in shallow water-table wells at the end of the month were nearly identical to levels at the end of July.

HAWAII

Streamflow generally decreased on the western islands of Oahu and Kauai and was below the normal range. Conversely, in the eastern part of the State, on the islands of Hawaii and Maui, monthly mean flows at the index stations increased and were above the normal range.

WATER RESOURCES REVIEW

August 1977

Based on reports from the Canadian and U.S. field offices; completed September 8, 1977

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for August based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for August 1977 is compared with flow for August in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for August is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range.* In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the August flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of August. Water level in each key observation well is compared with average level for the end of August determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of July to the end of August.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

EVALUATION OF GROUND-WATER DEGRADATION RESULTING FROM WASTE DISPOSAL TO ALLUVIUM NEAR BARSTOW, CALIFORNIA

The abstract and accompanying map and graphs below are from the report, *Evaluation of ground-water degradation resulting from waste disposal to alluvium near Barstow, California,* by Jerry L. Hughes: U.S. Geological Survey Professional Paper 878, 33 pages, 1975. This report may be purchased for $1.20 from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

Part of the alluvial aquifer along the Mojave River near Barstow, Calif., has been subjected to pollution from percolation of industrial wastes and municipal sewage for nearly 60 years. Effluent discharges have contained high concentrations of detergents, nitrogen, chromium, oil and grease, phosphates, phenols, and other organic and inorganic chemical substances. The poor quality ground water resulting from the discharge of these wastes has forced abandonment of several domestic wells because of taste, odor, and foaming and is endangering a well field serving the U.S. Marine Corps Supply Center at Nebo. The nature and occurrence of the degraded ground water, which is moving in very permeable river-channel deposits at an estimated rate of 1.0–1.5 ft (30–45 cm) per day, is described and outlined both areally and vertically. The concentration of dissolved solids, detergents, dissolved organic carbon, total nitrogen, and chloride were studied in three dimensions.

The distribution of chemical constituents in the ground water indicates that a plume of degraded water, produced by percolation from abandoned waste-disposal facilities near Barstow, is moving near the base of the aquifer. Since 1910 this degraded plume has moved downgradient about 4 mi (6.4 km). A more recent overlying plume of degraded water occurs near the downstream edge of the deeper plume. This overlying plume is produced by percolation from sewage-treatment facilities installed in 1968. Concentrations of detergents in ground water beneath this waste-disposal facility reflect the current use of readily biodegradable linear alkylate sulfonate type detergents, in contrast to the nonbiodegradable alkyl benzene sulfonate types in the deeper plume.

The concentration and distribution of nitrogen and chloride in ground water in the vicinity of the U.S. Marine Corps golf course suggest that the gradual increase in dissolved solids in the Marine Corps wells (fig. 1) is in part due to the use of treated sewage effluent on the golf course. Areal and vertical mapping of the degraded water indicates that the water supply at the Marine Corps Supply Center will also be affected by the degraded water in the river-channel deposits if no corrective measures are taken.

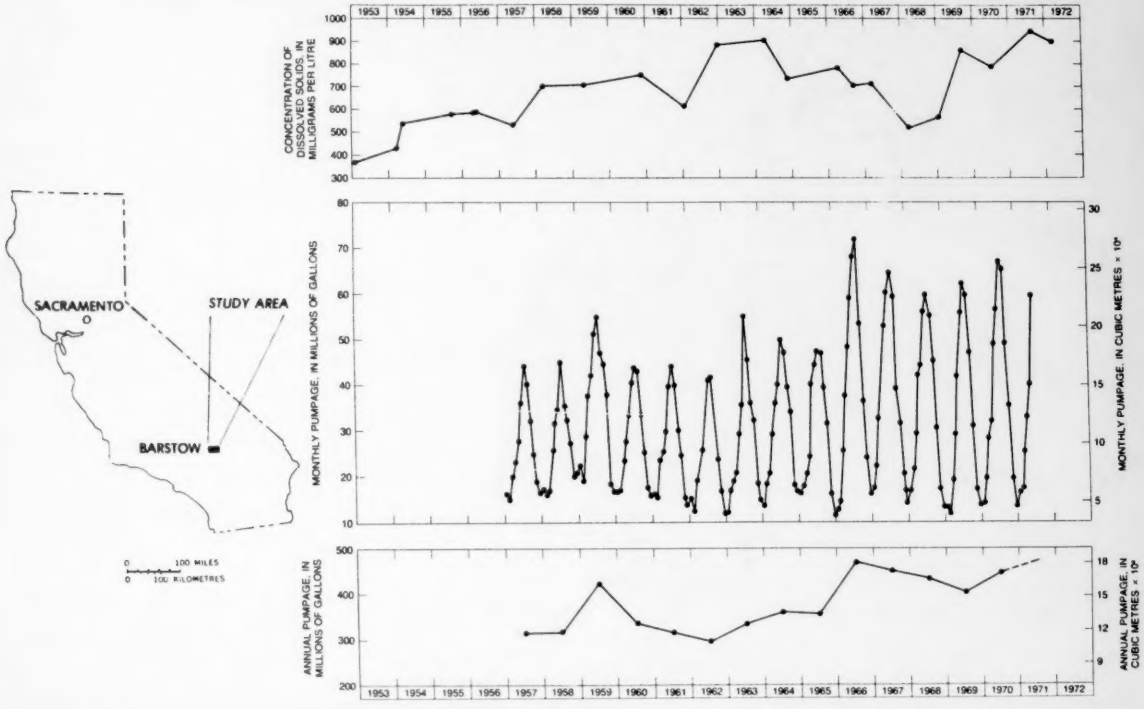

Figure 1.–Fluctuation of dissolved solids in well 9N/1W-13E1 (Nebo 4) and water-supply demands at the Marine Corps Supply Center (Nebo).

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